

FACTORS AFFECTING GREEN CONSTRUCTION PROJECT MANAGEMENT

Wasu Pittayasoponkij

Ph.D. Student in Engineering Law and Inspection, Faculty of Engineering,
Ramkhamhaeng University, Humark, Bangkok 10240 Thailand

Dr. Waranon Kongsong

Assistant Professor in the Engineering Law and Inspection, Faculty of Engineering,
Ramkhamhaeng University, Humark, Bangkok 10240 Thailand

Orcid: 0000-0003-2651-8476

Dr. Chaiwat Pooworakulchai

Lecturer in the Engineering Law and Inspection, Faculty of Engineering,
Ramkhamhaeng University, Humark, Bangkok 10240 Thailand

ABSTRACT

The objectives of this research were (1) to study the factors affecting the management of green construction projects and (2) to determine factors contributing to most effective outcomes. The research was designed to investigate the factors leading to success under green construction project management. Questionnaires were collected from representative groups involving in the management of green construction projects which were environmental personnel group, construction personnel group and legal personnel group. Analysis and factors prioritization were done by Relative Importance Index (RII) considering personnel factors, material factors, financial factors, managerial factors and eco-efficiency factors. After final analysis of factors affecting the management of green construction projects, results were categorized into 5 aspects for first and second most essential factors. For personnel aspect, attitude towards the project and understanding of the project were two leading factors respectively. In material aspect, leading factors were usage efficiency and price. In financial aspect, leading factors were cost increment and change in construction. In managerial aspect, leading factors were related document, approval process and project participant privilege from government. In eco-efficiency aspect, leading factors were material reuse/recycle capability enhancement and reduction in resources usage.

Keywords: Factor, management, green construction.

Cite this Article: Wasu Pittayasoponkij, Waranon Kongsong and Chaiwat Pooworakulchai, Factors affecting Green Construction Project Management, *International Journal of Management (IJM)*, 12(11), 2021, pp. 65-72.
<https://iaeme.com/Home/issue/IJM?Volume=12&Issue=11>

1. INTRODUCTION

1.1. Background and importance of the Problem

Construction projects in Thailand are currently leading the way in advanced construction project management. and modern to apply in a variety of ways including the development of construction technology along with the conservation of natural resources and environment continuously Therefore, the idea was to study the factors of green construction project management. including eco-efficiency in the management of green construction projects To study the effectiveness of management to make the business sector more competitive coupled with responsibility towards natural resources and the environment It is necessary to start management from the very beginning of the operation. To be able to control and achieve effective project management It is managed to be a tool that helps in the successful completion of construction projects effectively in the project management approach.

Study of factors affecting green construction project management. Construction projects consist of personnel in many departments such as employers, designers, project consultants, contractors, and supervisors. The scope of work should be clearly divided. in order for the project to run successfully. correct to the extent and project objectives In addition, in order to be able to carry out the planned work effectively. and work experience to analyze the factors affecting the management of green construction projects that have been found The construction project must comply with the rules of contract, form and other details. as agreed Therefore, it can be seen that many The parties that work together have different roles. This can lead to conflicts. Conflict factors include people, documents, and environment (laws, external factors, and regulations). [1] Conflict is another reason for the delay in project management. Most of the reasons are due to personnel problems. The cause of the delay in the construction project is the labor shortage problem. and delayed decision-making processes It is a problem that arises from the immediate problems of work or changes, including coordination between designers. with supervisor [2] for in Egypt Factors contributing to the delay in the implementation of the project, such as change order / scope change during construction. Assess the impact of expected delays. Decreased percentage of delay claims and the associated cost implications due to early detection of confirmed incidents. throughout the project [3]

Then analyze and prioritize the factors affecting the management of green construction projects in each aspect, namely personnel factors. material factor cost factor Project Management Factors and eco-efficiency factors From the preliminary literature review, it was found that The main issue for developing a green construction project management contract according to the construction standards found is the cost of project management. Quality control of both personnel and materials and efficient materials and equipment for green building projects [4] For Singapore, the challenges and obstacles of managing green building projects include (1) increased project costs; (2) a lack of communication and attention among project team members; (3) the high cost of implementing green practices; (4) lack of credible research on the benefits of green building; and (5) Lack of interest from customers [5] In addition, an important problem in promoting green construction projects is that the profitability cannot be seen clearly. Because there are many investment costs. Lack of work experience [6]

Green construction projects focus on cooperation, communication and understanding between participants. quality control of work to achieve the important results of the project The frequency of review meetings is also an important component to periodic quality control.

throughout the construction of the project This includes project managers. Field Supervisor, Quality and Cost Effects [7]

2. OBJECTIVES

- To study the factors affecting the management of green construction projects
- To study the variables that are the factors that cause the most important results.

3. RESEARCH METHODOLOGY

This research is a research by collecting data from documents, textbooks, books, articles, related research. To define issues related to the management of green construction projects for being a variable to create a query by collecting data from 3 groups of stakeholders, namely representatives of the environmental personnel group; Representative of the construction personnel group Representatives of the legal personnel group, consisting of employers, designers, project consultants, contractors, supervisors

Determine the minimum sample size based on the proportion of the number of vendors and government entities registered in the corporate e-GP system. A total of 132,170 cases with juristic persons, corporations and public limited companies that are traders with the government sector, totaling 79,505 cases [8] The minimum sample number was determined by statistical method according to the equation (1) and (2) [9] as follows

$$n_o = \frac{p \times q}{v^2} \quad (1)$$

$$n = \frac{n_o}{1 + \frac{n_o}{N}} \quad (2)$$

n_o	=	Initial sample estimate
p	=	Proportion of the target population
q	=	$1 - p$
v	=	Tolerance from the sample
N	=	total population

p is the proportion of the target population. obtained from the proportion of legal entities Companies and public limited companies that are government traders, totaling 79,505 per number of government traders registered in the e-GP system that is a juristic person. A total of 132,170 cases are as follows:

$$p = \frac{79,505}{132,170} = 0.6015$$

$$q = 1 - 0.6015 = 0.3985$$

which the sampling error v according to [10] recommendation, 10% is when the data is substituted in equation (1) to calculate a preliminary sample estimate. Therefore, the number of minimum samples was 23.97 samples, and the initial sample estimate was substituted for the values in equation (2). Therefore, the number of samples was determined to be an integer of 24 samples from 3 specific sample groups by assigning weights. each group is equal Based on the number of samples, the total number of samples is 72.

Measuring the level of factors affecting the management of green construction projects The criteria for measuring scores are divided into 5 levels as follows:

- 1 means that Level of effect on the management of green construction projects no effect
- 2 means that Level of effect on the management of green construction projects little effect
- 3 means that Level of effect on the management of green construction projects moderate effect

4 means that Level of effect on the management of green construction projects very effective

5 means that Level of effect on the management of green construction projects most effective

reliability test (Reliability) of the exam by using the questionnaire from the improvement in the content accuracy by experts and qualified The experiment was conducted with a sample of the same characteristics as the study population. The respondents were then analyzed for reliability using Cronbach's method, which is Cronbach's alpha coefficient. [11]

$$\alpha = \frac{N}{N-1} \left(1 - \frac{\sum S_i^2}{S_t^2} \right) \quad (4)$$

α	=	Confidence coefficient of the instrument used to measure
s_t^2	=	The variance of scores from all questions
$\sum s_i^2$	=	The sum of the variances for each score.
N	=	Total number of questions

The data from the questionnaire was used to analyze the ranking of factors affecting the management of green construction projects by group of variables in each aspect as well. Relative Importance Index (RII) [12]

$$RII = \frac{\sum_{i=1}^5 W_i X_i}{AN} \times 100\% \quad (5)$$

W_i	=	Criteria to measure the level of impact, ranging from 1-5.
X_i	=	The number of responses in each criterion
A	=	The highest measurement criterion is 5.
N	=	Total number of questionnaires

4. RESULTS AND DISCUSSION

The results of the study. Factors affecting the management of green construction projects. By categorizing factors in each aspect affecting the management of green construction projects. A total of 61 factors were divided into 8 personnel factors, 10 material factors, 6 cost factors, 12 project management factors, and 25 eco-efficiency factors. questionnaire from 3 groups of stakeholders, including representatives of the environmental personnel group; Representative of the construction personnel group Representatives of the legal personnel group consisting of employers, designers, project consultants, contractors, supervisors, totaling 85 samples, which from the minimum sample number of 72 samples, indicating that the information was 18.06% more than the initial sample number determination. reliability test (Reliability) by finding Cronbach's alpha coefficient by substituting the values in Equation (3) are 0.87, 0.85, 0.84, 0.83 and 0.95, respectively.

From the analysis and ranking of factors affecting the management of green construction projects in each aspect, namely personnel factors. material factor cost factor Project Management Factors and eco-efficiency factors with the Relative Importance Index (RII), which shows the relative importance of factors affecting the management of green construction projects. The results of the research showed that

4.1. Personnel

The results of the analysis and ranking of factors affecting the management of green construction projects in terms of personnel according to equation (4) from the questionnaire of the sample group. as shown in Table 1

Table 1 Results of the sequence analysis of factors affecting the management of green construction projects in terms of personnel

	Factors Affecting Green Construction Project Management	RII (%)	Ranking
1.	Specialization	81.9	4
2.	Experience working in green construction projects	82.6	3
3.	understanding of the project	85.6	2
4.	cooperation, participation	78.1	5
5.	Coordination and tracking	72.5	7
6.	knowledge, ability	75.3	6
7.	number of personnel	61.4	8
8.	positive attitude towards the project	88.7	1

From the results of the RII analysis, prioritize the factors affecting the management of green construction projects in terms of personnel. From the questionnaire for the opinions of the sample group No. 1, good attitude towards the project (RII 88.7%), which is a factor that can determine the direction of thinking, either positive or negative. To the implementation of green construction projects No. 2 Project understanding (RII 85.6%) is one of the key factors in the management of green construction projects from the planning, design, to the completion of the verification stage. Experience working in green construction projects (RII 82.6%) Experience contributes to the implementation of the project. Finding the cause of the problem as well as helping to find a solution to the problem that is correct, on point and quickly

4.2. Material

The results of the analysis and ranking of factors affecting the management of green construction projects in terms of materials according to equation (4) from the questionnaire of the sample group. Shown as shown in Table 2.

Table 2 Results of the sequence analysis of factors affecting the management of green construction projects in terms of materials

	Factors Affecting Green Construction Project Management	RII (%)	Ranking
1.	environmentally friendly building materials	69.9	8
2.	locally produced materials	61.6	10
3.	material quality control	73.6	6
4.	recycled material	63.5	9
5.	Performance	85.6	1
6.	maintenance	75.3	5
7.	Quantity/Quantity	81.2	3
8.	price	81.6	2
9.	benefits of use	75.5	4
10.	The designer determines the materials used in detail.	70.8	7

From the results of the RII analysis, prioritize factors affecting the management of green construction projects in terms of materials. From the questionnaire of the sample group, No. 1, efficiency (RII 85.6%), No. 2, price (RII 81.6%), No. 3, amount/quantity (RII 81.2%).

4.3. Cost

The results of the analysis and ranking of factors affecting the management of green construction projects in terms of cost according to equation (4) from the questionnaire of the sample group. Shown as shown in Table 3

Table 3 Results of the sequence analysis of factors affecting green construction project management in terms of cost

	Factors Affecting Green Construction Project Management	RII (%)	Ranking
1.	budget for the implementation of the project	72.2	3
2.	increased cost	78.1	1
3.	increased workload	65.9	5
4.	Disbursement in each period	59.8	6
5.	construction changes	77.9	2
6.	Adding Market Value	70.4	4

Based on the results of the RII analysis, prioritize the factors affecting the management of green construction projects in terms of cost. From the questionnaire for opinions of the sample group, No. 1, Cost increase (RII 78.1%), No. 2, Construction change (RII 77.9%), No. 3 Project implementation budget (RII 72.2%).

4.4. Project Management

The results of analysis and ranking of factors affecting green construction project management in terms of project management according to equation (4) from the questionnaire of the sample group. Shown as shown in Table 4.

Table 4 Results of the sequence analysis of factors affecting green construction project management in terms of project management

	Factors Affecting Green Construction Project Management	RII (%)	Ranking
1.	Related documents approval process	83.5	1
2.	Control / Audit / Assessment	72.2	5
3.	coordination between departments	72.0	6
4.	Project implementation period	62.4	12
5.	Location and project area	70.4	9
6.	government support	77.4	4
7.	Government benefits for program participants	80.0	2
8.	environmental law	69.4	11
9.	interest in environmental conservation	71.3	7
10.	tax benefits	79.8	3
11.	Incentives for green construction projects	70.6	8
12.	good corporate image	69.9	10

From the results of the RII analysis, prioritize the factors affecting the management of green construction projects in terms of project management. From the questionnaire for the opinions of the sample group, No. 1, related documents Approval Process (RII 83.5%) Tier 2 Government Benefit for Program Participants (RII 80.0%) Tier 3 Tax Benefit (RII 79.8%)

4.5. Eco-efficiency

The results of analysis and ranking of factors affecting the management of green construction projects in terms of eco-efficiency according to equation (4) from the questionnaire of the sample group. as shown in Table 5

Table 5 Results of the sequence analysis of factors affecting the management of green construction projects in terms of eco-efficiency

	Factors Affecting Green Construction Project Management	RII (%)	Ranking
1.	reduce water use	67.3	21
2.	reduce energy consumption	80.7	4
3.	reduce resource consumption	81.4	2
4.	Reduce the release of toxic substances into the environment	79.5	5
5.	Strengthening material reuse potential	83.1	1
6.	Promote the use of renewable resources	81.2	3
7.	increase the shelf life of the product	73.9	9
8.	Increase the service level of the products and strengthen the service business.	71.5	14
9.	climate change	75.5	7
10.	ozone depletion	64.2	25
11.	Ecotoxicity	73.4	11
12.	air pollution emissions	76.2	6
13.	water pollution emissions	73.6	10
14.	soil emissions	72.7	12
15.	Emissions in the form of solid waste / waste	69.4	18
16.	Emissions in the form of hazardous materials	70.6	15
17.	noise pollution	68.7	20
18.	raw material acquisition process	70.4	16
19.	transport procedure	68.9	19
20.	The process of bringing raw materials to use in production	69.9	17
21.	Carcass/waste disposal procedures	72.0	13
22.	goal setting and clear boundaries Product revenue	74.8	8
23.	Product revenue	65.2	24
24.	Amount of products produced	65.9	23
25.	Environmental Impact Assessment	67.1	22

Based on the results of the RII analysis, prioritize factors affecting the management of green construction projects in terms of eco-efficiency. From the questionnaire for the opinions of the sample group, the first order was to enhance the reuse of materials (RII 83.1%), the second was to reduce the use of resources (RII 81.4%), and the third was to promote the use of renewable resources (RII 81.2%).

5. CONCLUSION

The results of the study of factors affecting the management of green construction projects from asking the opinions of the target group by collecting data from 3 groups of stakeholders, namely representatives of the environmental personnel group; Representative of the construction personnel group Representatives of the legal personnel group consisting of employers, designers, project consultants, contractors, and supervisors are then analyzed and prioritized factors affecting the management of green construction projects in each aspect, namely personnel factors. material factor cost factor Project Management Factors and eco-efficiency factors with the Relative Importance Index (RII), where the relative importance index represents the factors affecting the management of green construction projects. including (1) Personnel, the highest priority is a good attitude towards the project (RII 88.7%), which is a factor that can determine the direction of thinking, either positive or negative. To implement a green construction project (2) Materials The highest priority is efficiency (RII 85.6%). If the material can be used effectively. It will greatly contribute to the management of green construction projects. (3) Cost: The highest priority is increased costs (RII 78.1%) because green construction projects have higher costs than general construction projects. And the payback

period tends to be longer than that of general construction projects. (4) Project management. The highest priority is the relevant documents. The approval process (RII 83.5%) is more volumetric than conventional construction projects, requiring more time and workload (5) in terms of eco-efficiency. The top priority is to enhance material recycling capacity (RII 83.1%).

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